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Extending Cross-Generational Knowledge Flow Research in Edge Organizations

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Extending Cross-Generational Knowledge Flow Research in Edge Organizations

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Abstract

Today's organizations need to be adaptive and agile in order to deal with the rapidly changing environment and competitive pressures. Part of the challenge in doing so is examining the knowledge flows and knowledge gaps within the organizations, especially cross-generational knowledge flows. This paper is an extension of the authors' previous work in cross-generational knowledge flow research in edge organizations. Specifically, the current research is applying ontologies in this domain to then construct a survey instrument for application in two edge-like case organizations (one in the military and one in industry). Social/organizational network analysis is then used to gain insight into cross-generational knowledge flows in these organizations in order to recommend findings on the critical success factors needed to ensure positive cross-generational knowledge flows in edge organizations.

Keywords: knowledge management, cross-generational differences, knowledge flows, ontology, social network analysis

1.0 Introduction

Our previously funded Edge Research project (Liebowitz et al., 2007a) focused on cross-generational knowledge flows in edge organizations. We found that cross-generational biases affect tacit knowledge transfer between edge-like teams. Our findings were based on the use of our university graduate capstone teams whereby three to six individuals per team worked together on semester-long "real" projects. Our research was novel in that the combination of intergenerational differences [Wei, 2006; DiRomualdo, 2006], tacit knowledge transfer [Foos et al., 2006; Liebowitz, 2006a; 2006b; 2008; in press; Nissen, 2006; 2007; Perrolle and Moris, 2007], and edge organizations [Alberts & Hayes, 2003; 2007] had never been studied.

One limitation of our research was the need to address how edge-like teams can overcome possible cross-generational biases in order to enhance knowledge flows for improved team productivity. Our prior research tested various hypotheses, but stopped just short of recommending ways to counter these intergenerational differences to stimulate team efficiency and effectiveness. Additionally, case studies in defense and industry need to be collected, analyzed, and discussed to show how edge-like teams have overcome difficulties resulting from cross-generational knowledge flows. The focus of our current research addresses these limitations.

Specifically, we first examine the field of ontologies to build an ontology for cross-generational knowledge flows in edge organizations. Once the ontology is built, the next step is apply the ontology as a framework in order to determine types of knowledge and cross-generational knowledge flows that are critical to the success of edge organizations. A survey instrument can then be designed in order to identify these knowledge flow and knowledge gaps in three case studies. Social/organizational network analysis will then be used to help identify, understand, and visualize these knowledge flows in order to provide recommendations on critical success factors for enabling cross-generational knowledge flows in edge organizations.

To date, the initial ontology for cross-generational knowledge flows in edge organizations has been constructed. Protégé, from Stanford University and the leading ontology development software tool, has been used to assist in this endeavor. The survey instrument was developed, and the two edge-like case organizations used in our study are: US Navy/Defense—a Navy Knowledge Management Team; Industry—an Intelligent Transportation System Company's Information Technology Team. The survey was sent out in early November 2007 and the responses were returned in December 2007. The responses were encoded and social/organizational network analysis was applied through using the social network analysis tool UCINET/NetDraw [www.analytictech.com].

2.0 Ontology Development for Cross-Generational Knowledge Flows in Edge Organizations

An ontology can be viewed as a semi-formal model of a real-world domain which portrays that domain in terms of its most imperative concepts as well as the interaction among them (Swartout, 1999). By creating an ontology for a domain, the developer endeavors to formalize the domain, explicitly listing out the concepts (things) in that field and the way that they relate to one another.

The focal idea for building this ontology is to capture the main concepts and their inter-relationships in the domain of cross-generational knowledge flows in edge organizations. To provide better integration with existing knowledge sources, we relied closely on the existing vocabulary and expressions available in both Liebowitz et al. (2007) and the key edge organization references [Alberts and Hayes (2003, 2007)]. Before we started building our ontology, we reviewed the best practices of ontology design principles and methodologies, as well as the available ontology development

software tools. Ontology development could be equivalent with software engineering in complexity and principles of development. In the software engineering field, many matured methodologies already exist, such as Rational Unified Process (Hunt, 2003) or Extreme Programming (Beck, 2000). Most of the ontology development authors (Gomez et al., 2004; Noy and McGuinness, 2001; Sure and Studer 2002) recognize that the field of ontology development is not as mature as the field of software engineering and presently there is no universal set of instituted and commonly accepted practices.

We followed the ontology methodology proposed by Noy and McGuinness (2001) for our ontology development. We carefully analyzed our key reference sources to look for important classes, instances, and relationships between terms. We used Protégé 3.1.1 (2007), developed by Stanford University, for the ontology development and encoding. Protégé provides visual interfaces for making classes, individuals, and properties, as well as an interface to test the ontology with different queries. It also provides support to generate graph diagrams that are almost intuitive and easy to understand. We created the ontology with its visual interface. Figure 1 shows the visual interface which has different tabs.

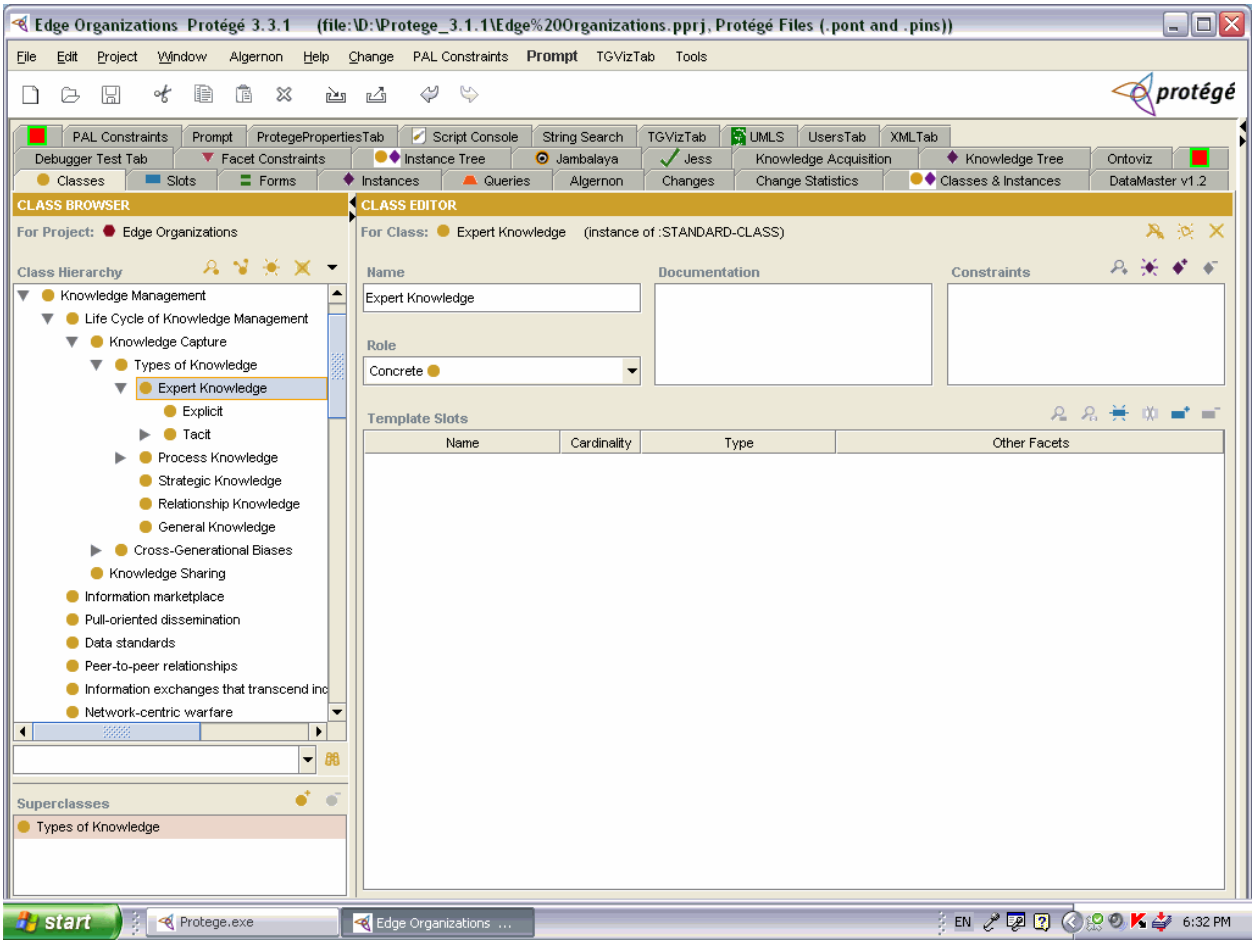


Figure 1: Screen Shot of Protégé in the Cross-Generational Knowledge Flow in Edge Organization Domain

More tabs can be configured from the menu. The main tabs used are: "Classes" (domain concepts) and their attributes and relationships, "Properties" for creation of properties and setting their ranges or restrictions, and "Individuals" for creation of instances in our data model. Jambalaya is a plug-in created for Protégé which visualizes regular Protégé and OWL knowledge bases. This visualization technique is designed to enhance browsing, exploring and interaction with the knowledge structure. Figure 2 shows view from our ontology with Jambalaya.

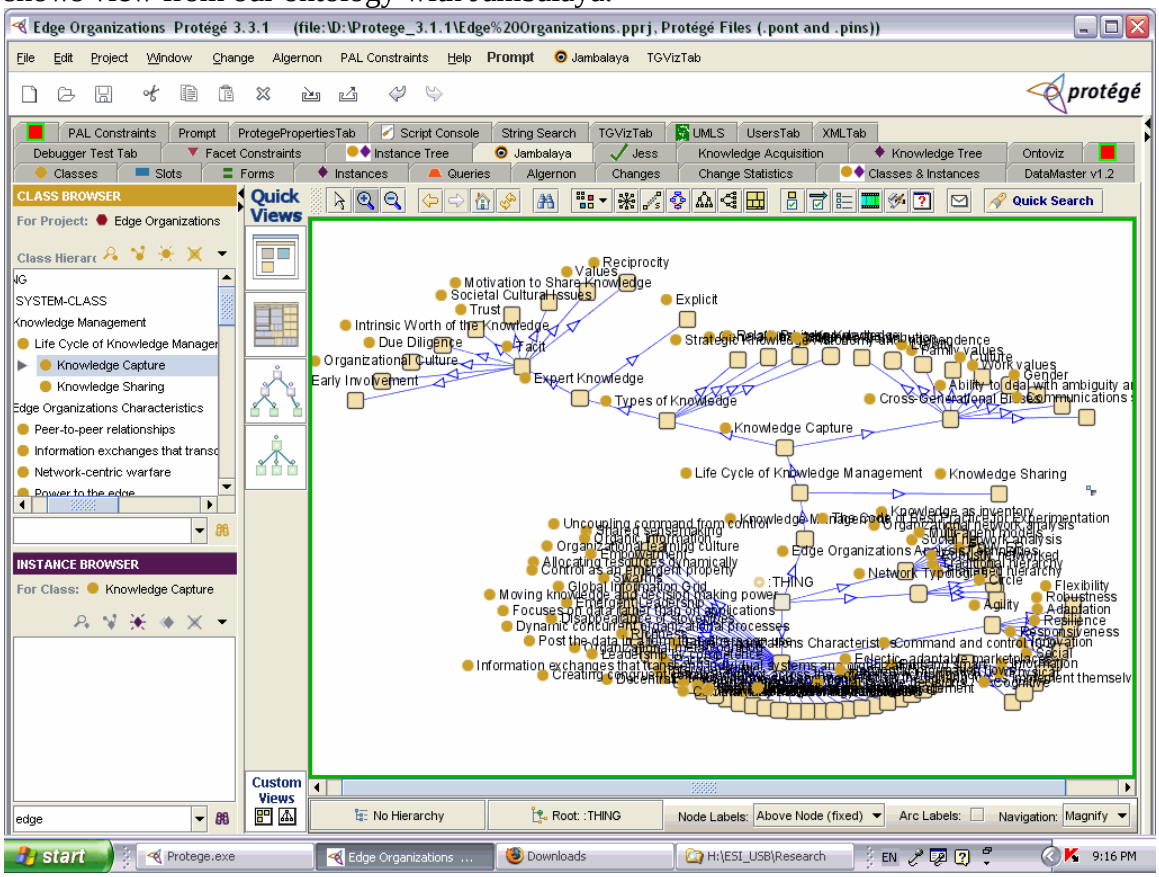


Figure 2: Screen Shot Using the Jambalaya Plug-in for Protégé for Our Domain

The resulting models (classes and instances) can be loaded and saved in various formats, including Extensible Markup Language (XML), Unified Modeling Language (UML), and Resource Description Framework (RDF). Protégé also provides a very scalable database back end. From a programmer's perspective, one of Protégé's most attractive features is that it provides an open source Application Programming Interface (API) to plug in Java components and access the domain models from its own application. As a result, systems can be developed very rapidly - starting with the underlying domain model, letting Protégé generate the basic user interface, and then gradually write widgets and plug-ins to customize its look-and-feel and behavior.

3.0 Analyzing Cross-Generational Knowledge Flows in Edge Organizations

Based on the ontology developed in Section 2.0, a survey instrument was developed to determine cross-generational knowledge flows in two edge-like case organizations (one in the military and one in industry). Social/organizational network analysis is being used to map these knowledge flows and knowledge gaps in the organizations. Liebowitz (2007c), Liebowitz et al. (2007b), and Cross and Parker (2004) have written extensively about the importance of the informal organization and how innovation is increased through the informal, social networks in organizations. Katzenbach (2007) also echoes these points through their recent report on "The Informal Organization". Clippinger (in press) reinforces the importance of social networks in edge organizations through leveraging trust and community building. Yoo et al. (2007) showed that knowledge sharing practices were enacted differently from the official strategy in order to close the post-merger knowledge gap. Even when looking across generations, a Generation Y'er (or some call Generation Net) was quoted on the local news as saying that "my success depends upon my connections". Thus, social/organizational network analysis can be very useful to help map and visualize these cross-generational knowledge flows.

The survey instrument, derived from Liebowitz and Plexus Scientific Corporation, contains the following questions as shown below:

A. Basic Demographics

1. What is your full name:_____

2. How long have you been working in your current organization?
   Please choose only one of the following:
   ____Less than 1 year
   ____1-3 years
   ____4-6 years
   ____7-10 years
   ____11-15 years
   ____16 years or more

3. What is your primary role or function within the organization?

   _____

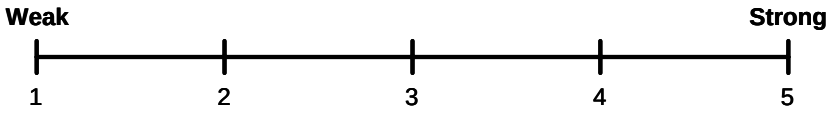
4. What generation were you born?
   _____"War" generation (1945 or earlier)
   _____ Baby boomers (1946-1965)
   _____ Generation Xers (1966-1979)
   _____ Generation Yers (1980 or later)

5. How many years of professional experience do you possess?
   ____Less than 1 year

____1-3 years
____4-6 years
____7-10 years
____11-15 years
____16 years or more

B. Team Characteristics ("Team" refers to your specific project/program team; if this doesn't apply, then kindly use "team" to be your department).

1. Please respond to each of the following questions with a rating of 1-5.



	Rating
a. How well do you rate your team's ability to work together with other teams?	
b. How well do you rate your team's agility in terms of being well suited to deal with uncertainty and unfamiliarity?	
c. How well is there a shared understanding of command intent among your team?	
d. How well do you rate your team's ability in terms of generating interactions between and among any and all team members?	
e. How well is there situational leadership on your team whereby no single person will be in charge all the time?	
f. How well would you rate your team as being non-hierarchical?	
g. How well would you rate your team's degree of competency?	
h. How well would you rate your team's ability as being a good multi-tasker?	
i. How well do you rate your team's ability to utilize information technology via a robust network to facilitate information sharing?	
j. How well does your team exhibit strong work values among your team?	
k. How well does your team exhibit strong family values among your team?	
l. How well does your team exhibit strong communications flow among your team?	
m. How well does your team exhibit strong interpersonal trust among your team?	

n. What is the degree of cultural issues affecting your team?	
o. How well does your team encourage incentives to share knowledge?	
p. How well does your team exhibit reciprocity of knowledge shared among your team?	
q. How well does your team exhibit loyalty among your team members?	
r. What is the degree of gender issues affecting the team?	
s. What is the degree of cross-generational biases among the team?	

Please use the table on the following pages for questions 2-8.

2. Please provide us with the name of each person (internal and external to your organization) with whom you interact in order to accomplish your tasks or assist him/her in accomplishing his/her tasks? Kindly mark "I" for internal person and "E" for external person. *Please include their department/ organization as well.*

3. How long have you known this person?

   a = less than 1 year
   b = 1-2 years
   c = 3-5 years
   d = 5-10 years
   e = more than 10 years

4. Please indicate his/her hierarchical level within the organization relative to your own.

   a = higher than yours
   b = equal to yours
   c = lower than yours

5. Please indicate the frequency with which you interact with this person for information and collaboration purposes.

   a = seldom
   b = sometimes
   c = often
   d = very often

6. Who usually initiates the interaction?

   a= I generally initiate
   b= He/she generally initiates
   c= Equal amounts of initiation

7. Do you turn to this person for decision-making information, general information, or as a sounding board for ideas? *Please indicate all that apply. (More than one answer may apply; e.g., D and S.)*

   D = decision-making information
   G = general information
   S = sounding board for ideas
   O = other (please specify)

8. What topic(s) of information do you usually discuss with this person?

3.1 Survey Responses and Analysis

Two organizations were used for our cross-generational edge teams. The first was a Navy knowledge management team and the second was an intelligent transportation system company IT team. We are looking at the following types of questions: (1) Does generation, tenure in the organization, and/or years of professional

experience have an impact on the types of knowledge that are exchanged via cross-generational knowledge flows in edge organizations, in order for the organizations to meet their strategic objectives? (2) What factors suggest a successful cross-generational knowledge flow? (3) What factors are most important to an edge organization for promoting cross-generational knowledge flows? We have compiled the responses from the surveys in order to apply our social/organizational network analysis tool, UCINET/NetDraw [www.analytictech.com], to help analyze and visualize the cross-generational knowledge flows in these edge-like organizations [Liebowitz, 2007c]. This allows us to gather insight and recommend critical success factors for ensuring cross-generational knowledge flows in edge-like organizations.

According to the survey responses as shown in Table 1 and Figure 3, questions (a) through (i) relate to the characteristics of an edge organization. Questions (j) through (s) relate to characteristics of cross-generational knowledge flows. Interestingly, the average ratings from the team members of the case organizations show, within some slight varying degrees, that they possess the necessary characteristics of being an edge-like team. From Net's and Telv's respondents, some team members were positioned throughout the world with a cadre of team members being situated in the same area. In Net's and Telv's ratings, the only edge characteristic which wasn't fully satisfied was the team being non-hierarchical. In both cases, an average neutral response was indicated by the team respondents.

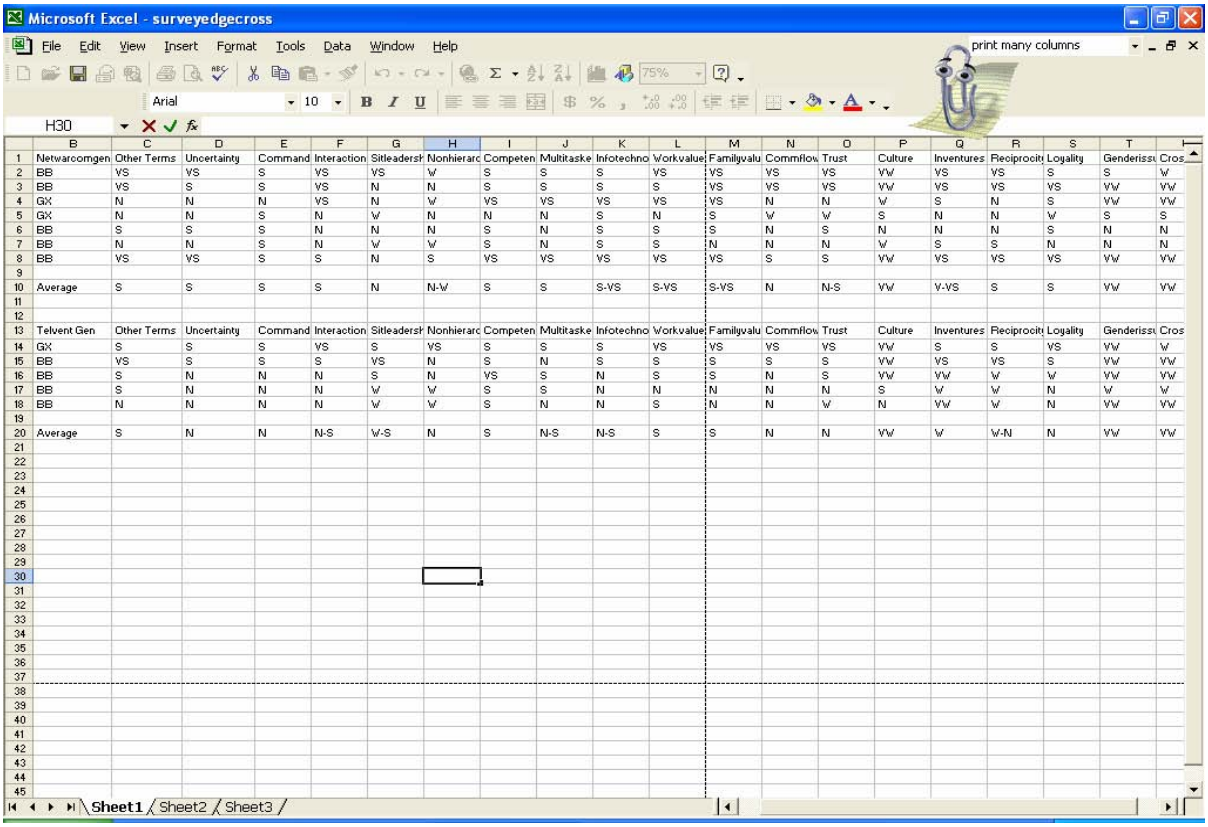
In terms of the survey respondents average ratings dealing with cross-generational knowledge flows, questions (j) through (s) covered the main attributes based on Liebowitz et al. (2007a). The average ratings generally showed that Net and Telv displayed the necessary characteristics for strong cross-generational knowledge flows within the team. However, there were some trust, reciprocity, and communication flow issues that existed, mostly with the Telv team, which could inhibit how successful the team would be in cross-generational knowledge flows.

Table 1: Survey Average Ratings Relating to Team Characteristics

	Average Rating
a. How well do you rate your team's ability to work together with other teams?	**Net: S** **Telv: S**
b. How well do you rate your team's agility in terms of being well suited to deal with uncertainty and unfamiliarity?	**Net: S** **Telv: N**
c. How well is there a shared understanding of command intent among your team?	**Net: S** **Telv: N**
d. How well do you rate your team's ability in terms of generating interactions between and among any and all team members?	**Net: S** **Telv: N-S**
e. How well is there situational leadership on your team whereby no single person will be in charge all the time?	**Net: N** **Telv: W-S**

f. How well would you rate your team as being non-hierarchical?	**Net: N-W** **Telv: N**
g. How well would you rate your team's degree of competency?	**Net: S** **Telv: S**
h. How well would you rate your team's ability as being a good multi-tasker?	**Net: S** **Telv: N-S**
i. How well do you rate your team's ability to utilize information technology via a robust network to facilitate information sharing?	**Net: S-VS** **Telv: N-S**
j. How well does your team exhibit strong work values among your team?	**Net: S-VS** **Telv: S**
k. How well does your team exhibit strong family values among your team?	**Net: S-VS** **Telv: S**
l. How well does your team exhibit strong communications flow among your team?	**Net: N** **Telv: N**
m. How well does your team exhibit strong interpersonal trust among your team?	**Net: N-S** **Telv: N**
n. What is the degree of cultural issues affecting your team?	**Net: VW** **Telv: VW**
o. How well does your team encourage incentives to share knowledge?	**Net: V-VS** **Telv: W**
p. How well does your team exhibit reciprocity of knowledge shared among your team?	**Net: S** **Tel: W-N**
q. How well does your team exhibit loyalty among your team members?	**Net: S** **Telv: N**
r. What is the degree of gender issues affecting the team?	**Net: VW** **Telv: VW**
s. What is the degree of cross-generational biases among the team?	**Net: VW** **Telv: VW**

Figure 3: Survey Responses on Team Characteristics



In reviewing some of the literature on generational diversity as related to succession planning [Bedell, 2007], organizations must master the Baby Boomer-Gen. X-Gen. Y divide. In order to plan for the future, Bedell (2007) discusses some techniques in terms of ensuring better succession planning through involving the Generation Y'ers:

1. Onboarding: Take a cohort approach, connect their work, solicit their input, and have fun.
2. Training: Include Gen X and boomers with the Gen Y'ers in the training to heighten generational diversity awareness.
3. Mentoring/Reverse Mentoring: Match Gen Y'er with a boomer, and let Gen Y'er be a "technology mentor".
4. Coaching: coach the team at the beginning and beyond.
5. Give them a seat at the table: get the Gen Y'er involved so they can contribute to the decision making process.
6. Passport Initiatives: Let the Gen Y'er "travel" to different functional and geographical areas within the company to bridge across the silos.

Multidimensional analysis portrays the clusters of interactions among the team members. For the Net team, people do not stick with only their "generational" colleagues. The same held true based on the years of professional experience—that is, the team members didn't just stay with those who had the same years of professional experience as they did.

In analyzing the Net team further, the generational issues were non-apparent in terms of whom they contact, the relationship with that individual, the level within the team, the frequency of contact, the initiator of the contact, and the information type sought. The average responses for the Net team were: contacted person's relationship was less than 1 year, lower level in the organization, often or very often frequency of contact, equal or self-initiated contacts, and decision making and general types of information sought.

Spring embedding can be used to position the network actors based on their geodesic distances and to analyze the direction and strength of the knowledge flows in the network [Polites and Watson, 2008]. Figure 4 shows spring embedding of the Net team by generation and clusters begin to emerge, as well as connections between the clusters. The BB refers to Baby Boomer, the GX refers to Generation X'er, and the P refers to a Person Contact. BB2, BB5, and GX2 are "cutpoints", meaning that these network members emerge if the network is cut into loosely coupled components. These individuals could be knowledge enablers, but could also play the role of knowledge inhibitors if wanted. Thus, the knowledge flows can be affected by these individuals. If you convert the P to their appropriate generation, as shown in Figure 5, some interesting results appear. Most of the persons contacted for advice were Baby Boomers. However, cross-generational knowledge flows take place between the Baby Boomers and the Generation X'ers, as shown by GX1 and GX2 contacting the BB, and BB1 and BB2 contacting the GX, and BB2, BB3, BB4, and BB5 contacting the BB.

Figure 4: Net Team Layout by Generation (Spring Embedding)

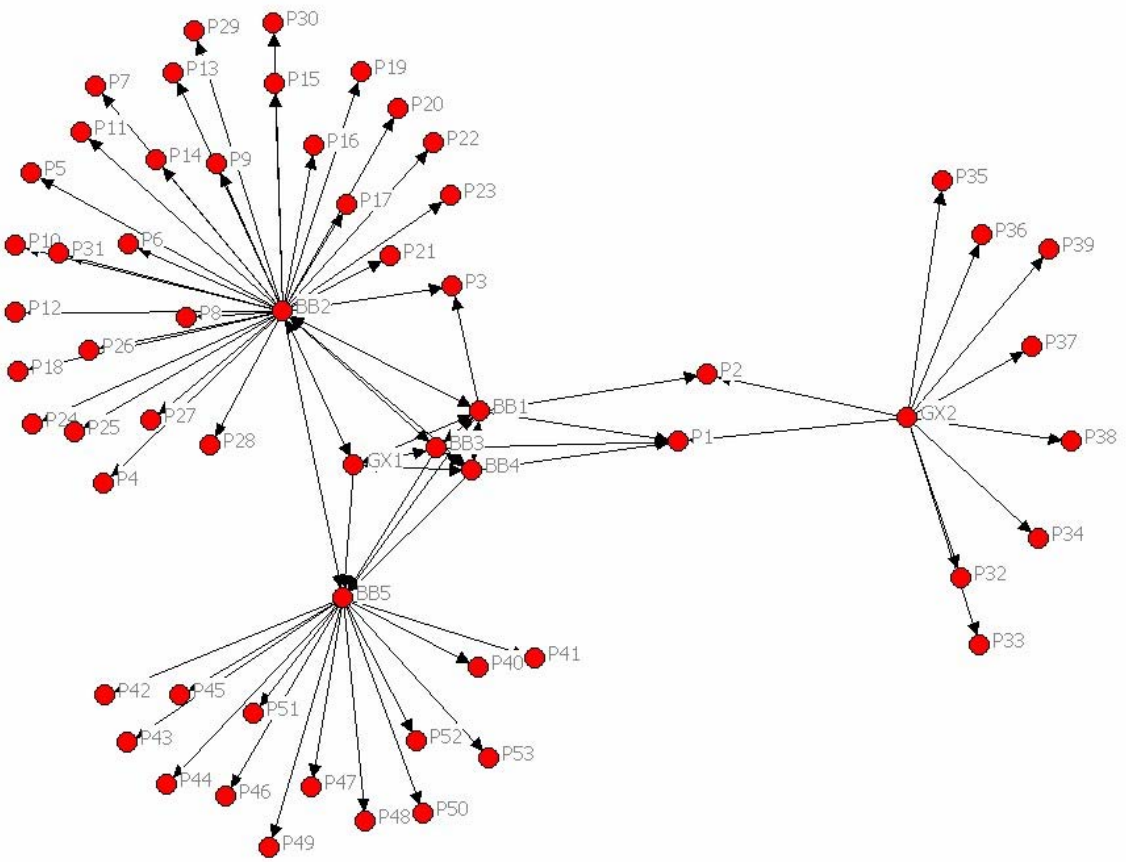
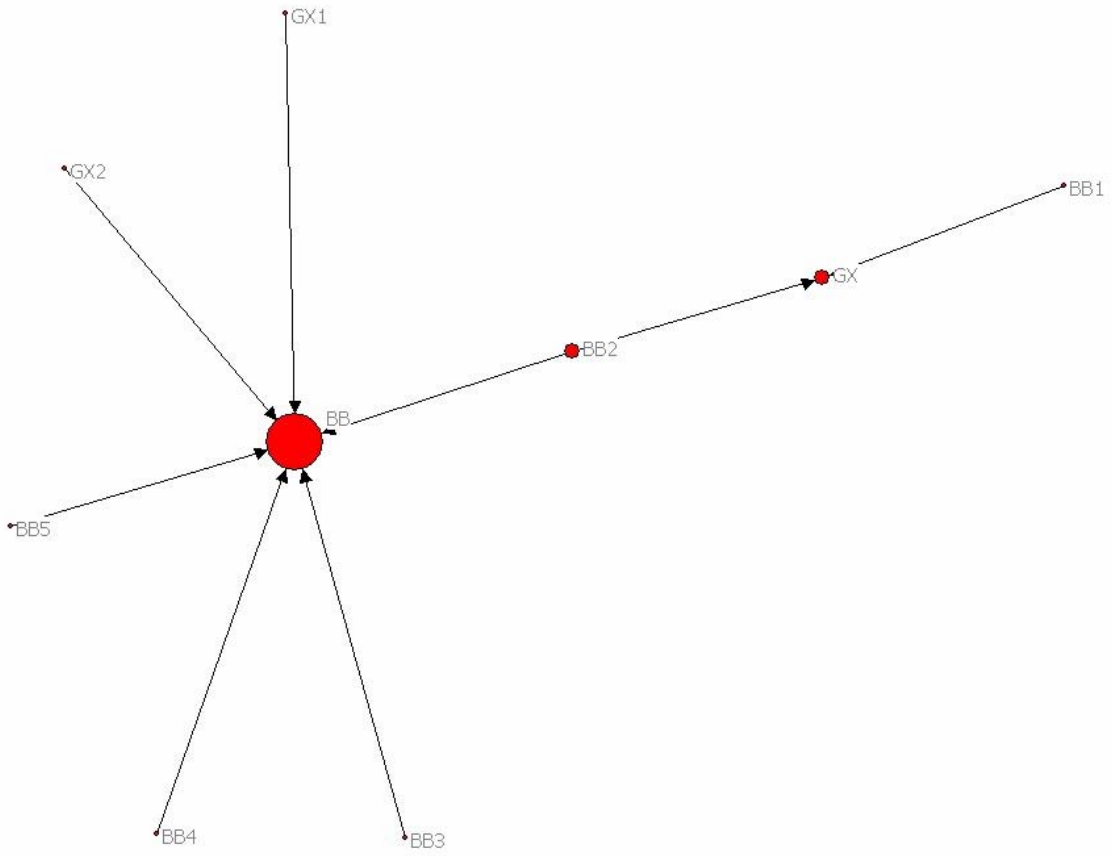

P29
P30
P13
P15
P19
P7
P20
P11
P16
P22
P14
P9
P5
P17
P23
P10
P31
P6
P21
P3
P12
P8
BB2
P26
P18
P2
BB1
P24
P25
P27
P28
P1
BB3
GX1
BB4
P4
GX2
P35
P36
P39
P37
P38
P34
P32
BB5
P33
P40
P41
P42
P45
P51
P43
P52
P53
P44
P46
P47
P48
P50
P49

Figure 5: Net Team (Degree of Centrality) by Converting All Nodes to Generations



In analyzing the Telv team, the team members were either Baby Boomers or Generation X'ers. The Boomers had either 7-10 years of professional experience or 11-15 years. The Gen X'ers had 4-6 years of professional experience. The Boomers on the team sought out people who had more years of experience (typically 5-10 years) than those sought out by the Gen X'ers (1-2 years). This isn't unusual as the Boomers had been working at Telv longer than the Gen X'ers and had developed longer relationships over those years. Figure 6 shows the reciprocal ties (lighter, red lines) and the non-reciprocal ties (darker, blue lines) between the Telv team members and their contacts in

terms of years of professional experience. The larger square shows a higher degree of centrality.

Figure 6: Telv Team and their Contacts in Terms of Years of Professional Experience

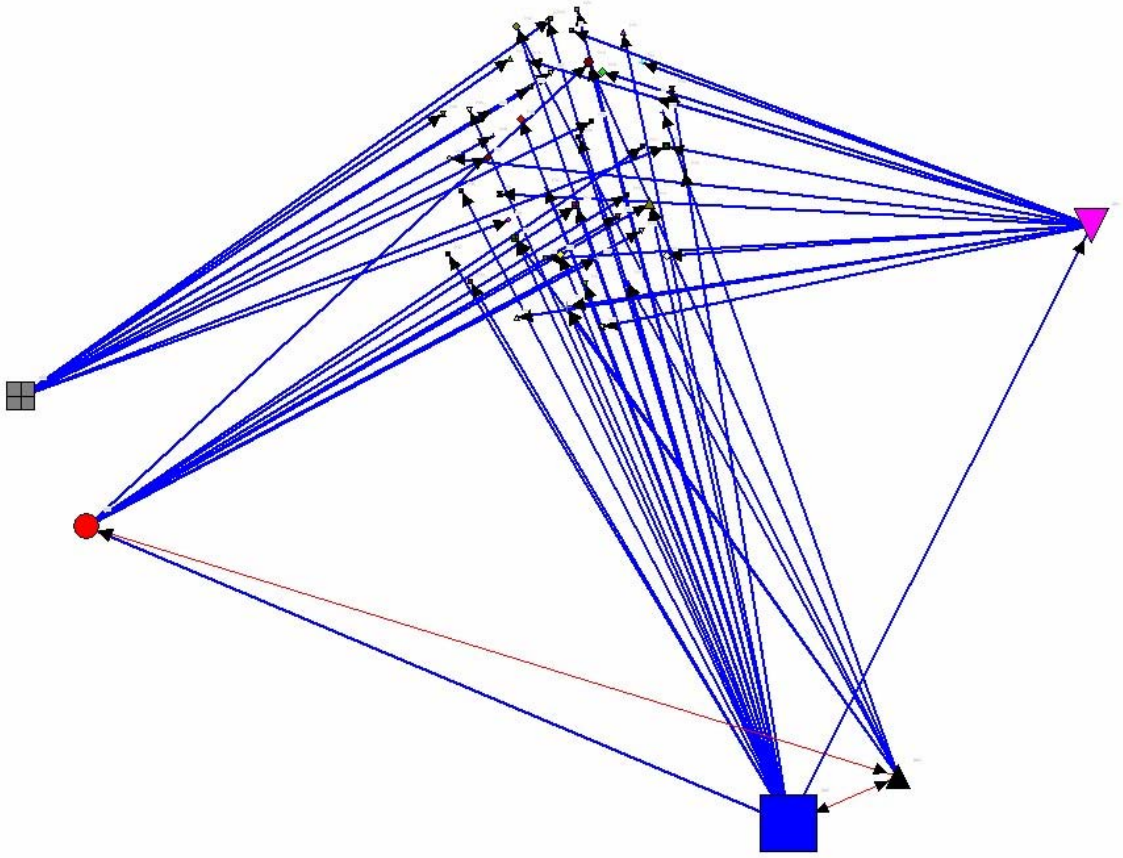


Figure 7 shows the Telv team in terms of betweenness centrality. Here, BB2 and GX1 have the highest values for betweenness—that is, they are the most sought after "go-betweens" within the Telv team. Figure 8 indicates the connections between the Telv team members and those they reach out for advice based on the number of years they know them.

In looking across the two generations on the team, there wasn't a difference in the hierarchy of those contacted (equal), the frequency of those contacted (often), or the initiator of those contacts (the other person usually initiates). The only slight difference between the two generations on the Telv team was that the Boomers with 7-10 years of professional experience sought out information for decision making and general purposes, whereas the Boomers with 11-15 years of experience and the Gen X'ers sought out people for decision making, general, and sounding board types of information.

In order to determine how successful the cross-generational knowledge flows are within the teams, we must associate them with the knowledge management (KM) strategic goals of the team. The strategic goals related to knowledge management deal with five categories: Adaptability/Agility (AA), Creativity/Innovation (C), Institutional Memory-Building (IM), Organizational Internal Effectiveness (IE), and Organizational External Effectiveness (EE). For example, Telv's adaptability goal is to rapidly commercialize new products and services, and its institutional memory-building goal is to retain critical knowledge before the individual leaves. We associated the specific knowledge topics indicated by the survey respondents with the five strategic KM goals. Then, we examined the knowledge flows across generations by individual and department/function as related to the knowledge topics and knowledge types. In this manner, we can see if there are any structural holes or knowledge gaps in terms of the cross-generational knowledge flows as contributing to the term's KM goals.

The spring embedded view of the Telv team, as shown in Figure 9, shows that the Systems Engineering department is the liaison between BB1 and BB3; GX1 is the liaison within the IT outsourced group in India; and BB4 (the team leader) has direct ties to senior management in the US and India. Probing deeper to examine the individuals by knowledge topic (Infotopic) and knowledge type (Infotype), Figures 10 and 11 show that the greatest connections among the Telv team individuals are with Adaptability/Agility (AA), Creativity (C), Organizational internal effectiveness (IE), and Organizational external effectiveness (EE). In addition, most of the individuals reach out to others in the Telv team for first, Decision Making information (denoted by the number 3 in Figure 11), and then General information (denoted by the number 1) and Sounding Board information (denoted by number 2—Other information is denoted by 0).

In looking across the organizational units on the Telv team by knowledge topic and knowledge type, Figures 12 and 13 show the following: Organizational internal effectiveness (IE) has the highest number of direct ties with the departments and thus is a high priority; the Human Resources (HR) and Consulting departments have the highest closeness values related to Institutional Memory (IM); and Organizational internal effectiveness (IE) possesses the highest betweenness value followed by Adaptability/Agility (AA). Also, the senior management members, as expected, have the closest ties to the decision making information (denoted by the number 3 in Figure 13).

Figure 7: Telv Team Betweenness Centrality

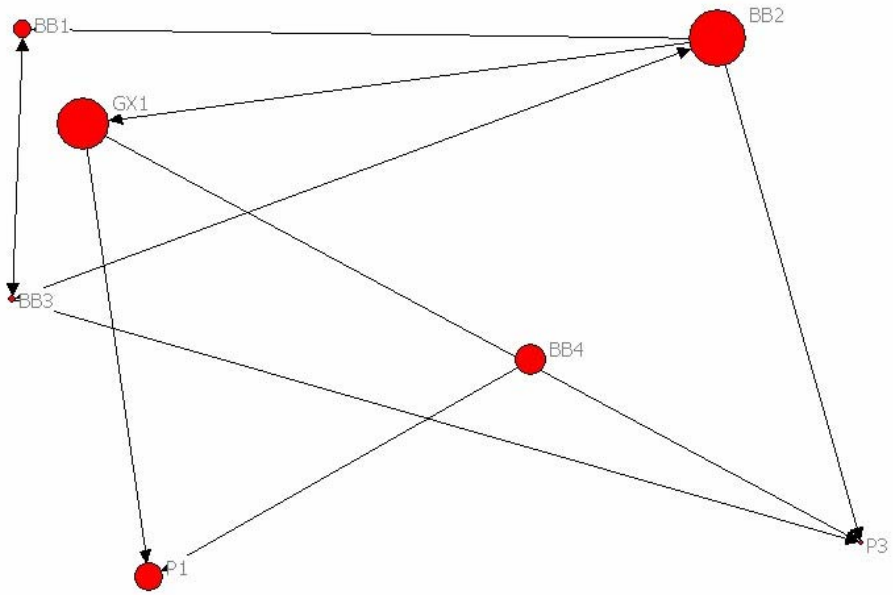


Figure 8: Telv Team: Relationship Length

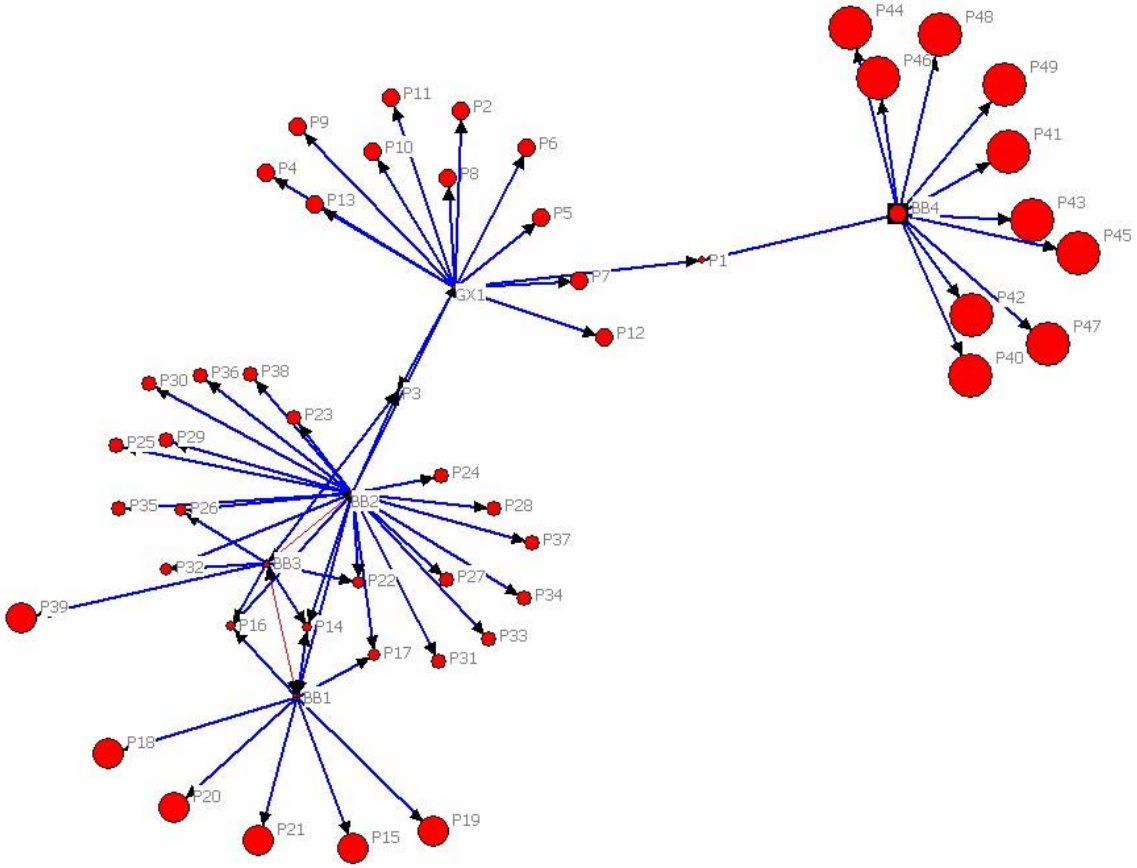


Figure 9: Telv Team Organizational Department Contacts: Spring Embedding

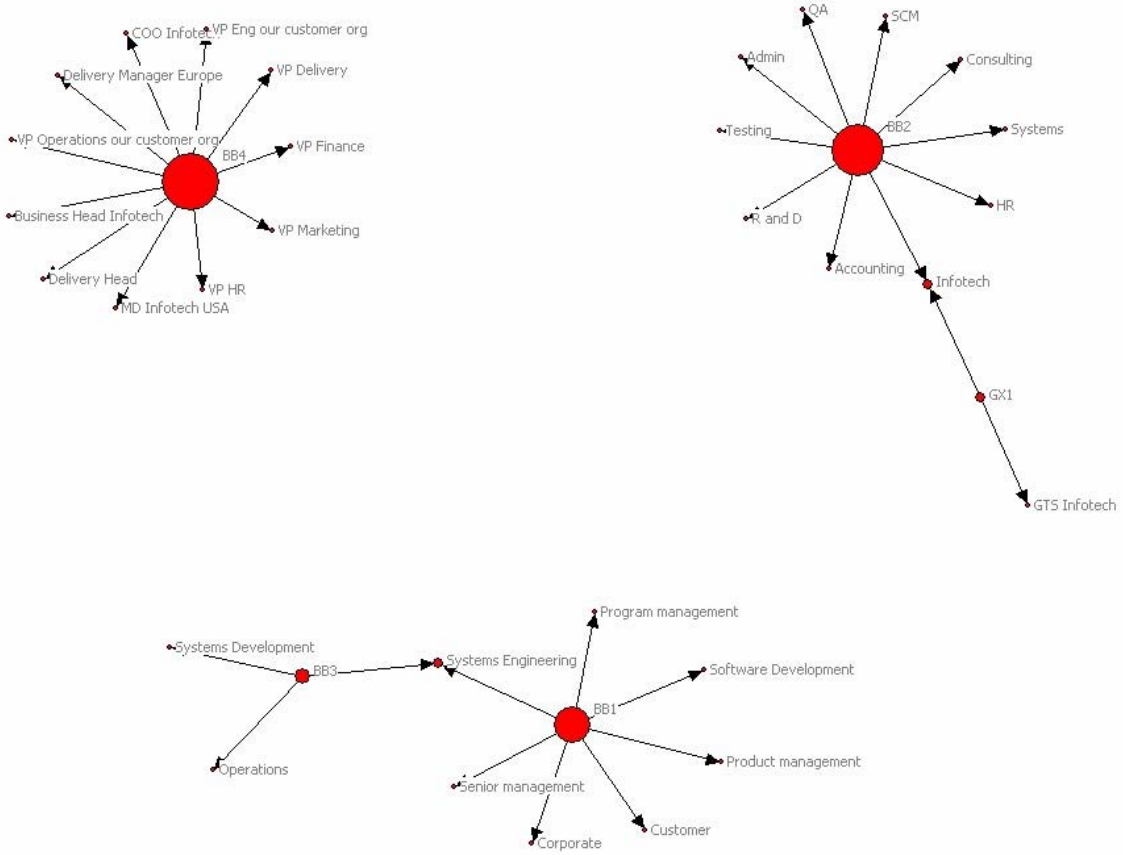


Figure 10: Telv Team ID versus Infotopic

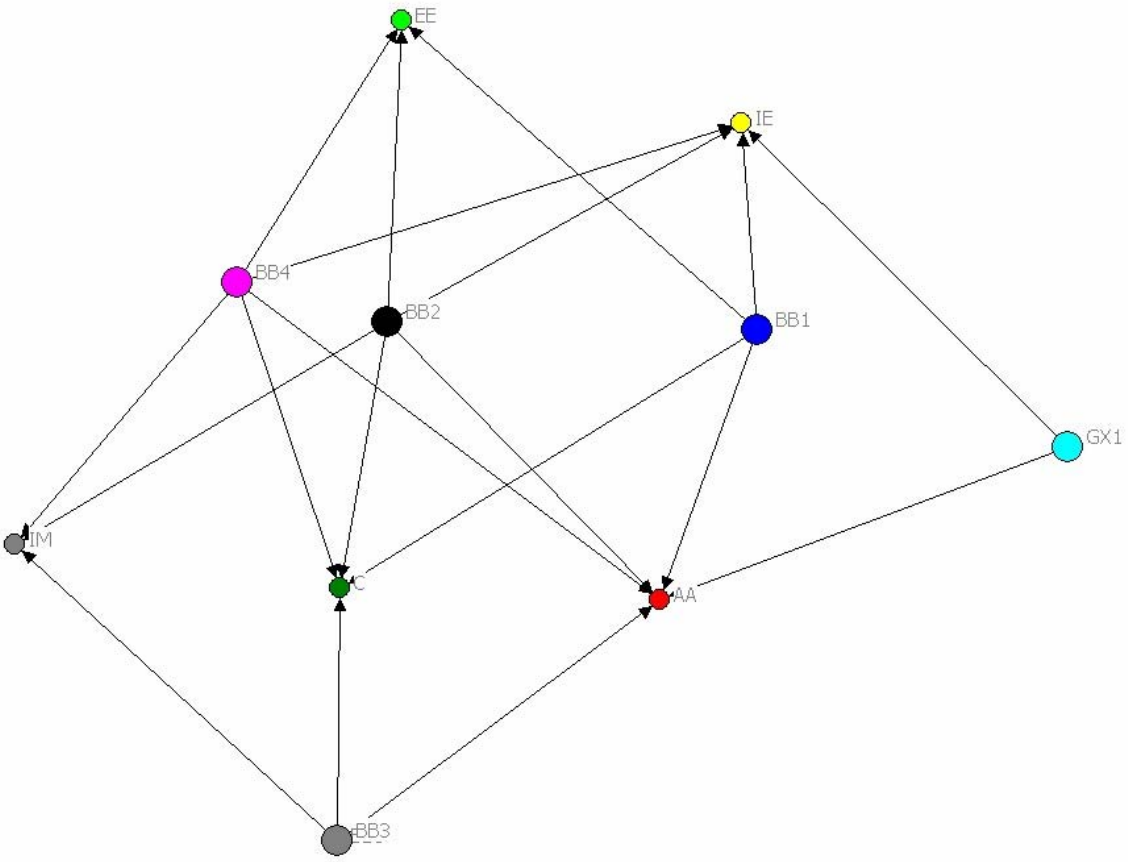


Figure 11: Telv Team ID versus Infotype

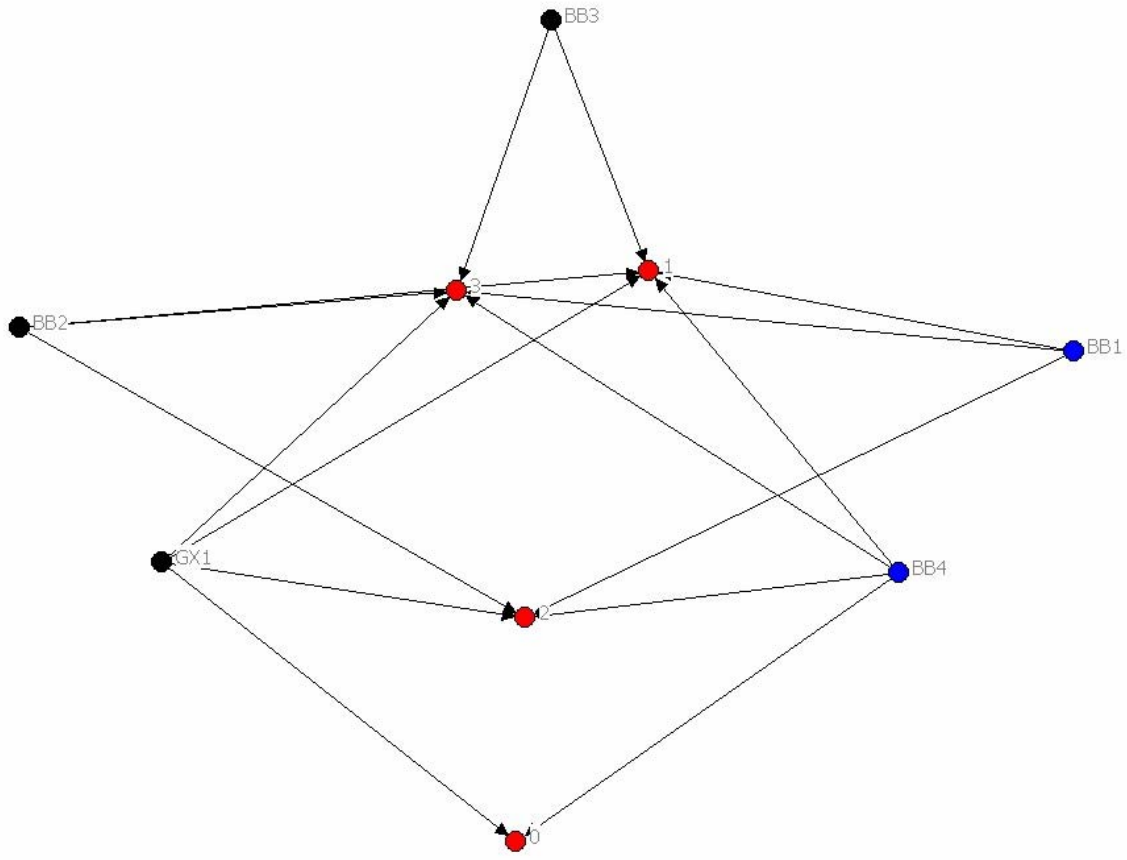


Figure 12: Telv Team Organizational Dept versus Infotopic

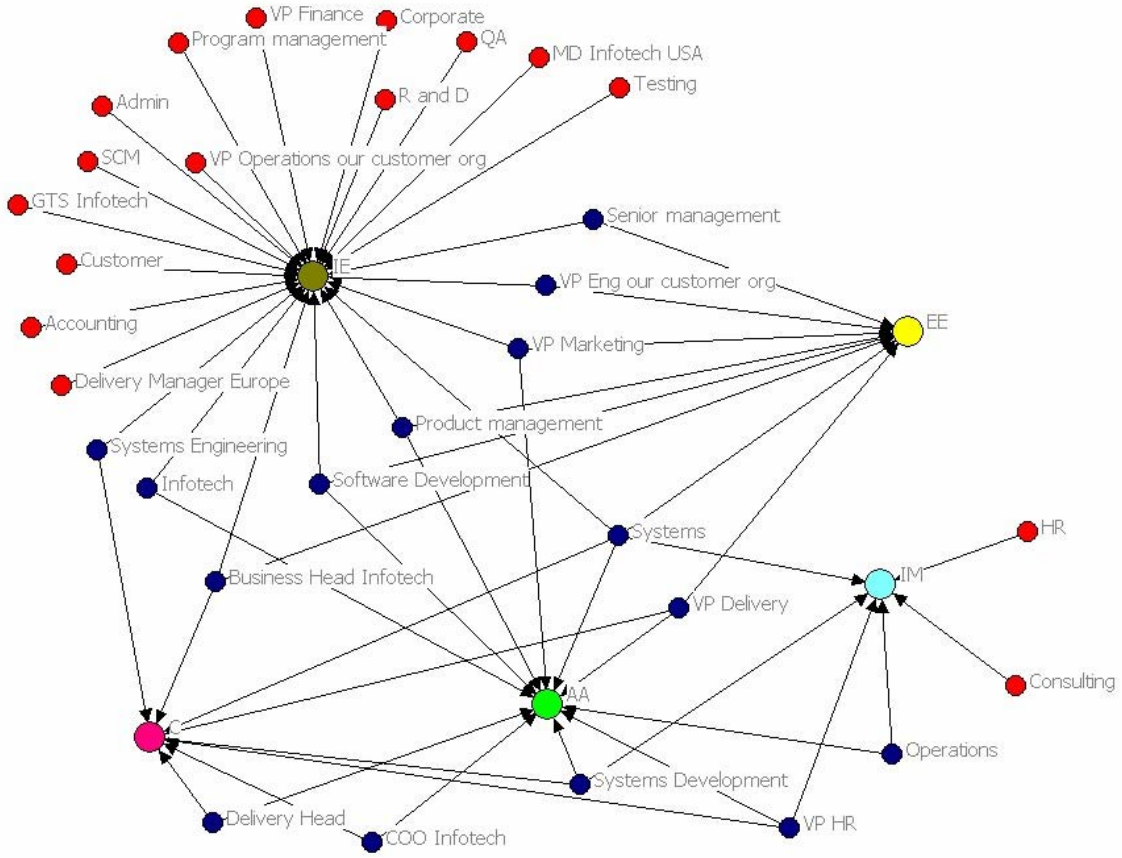
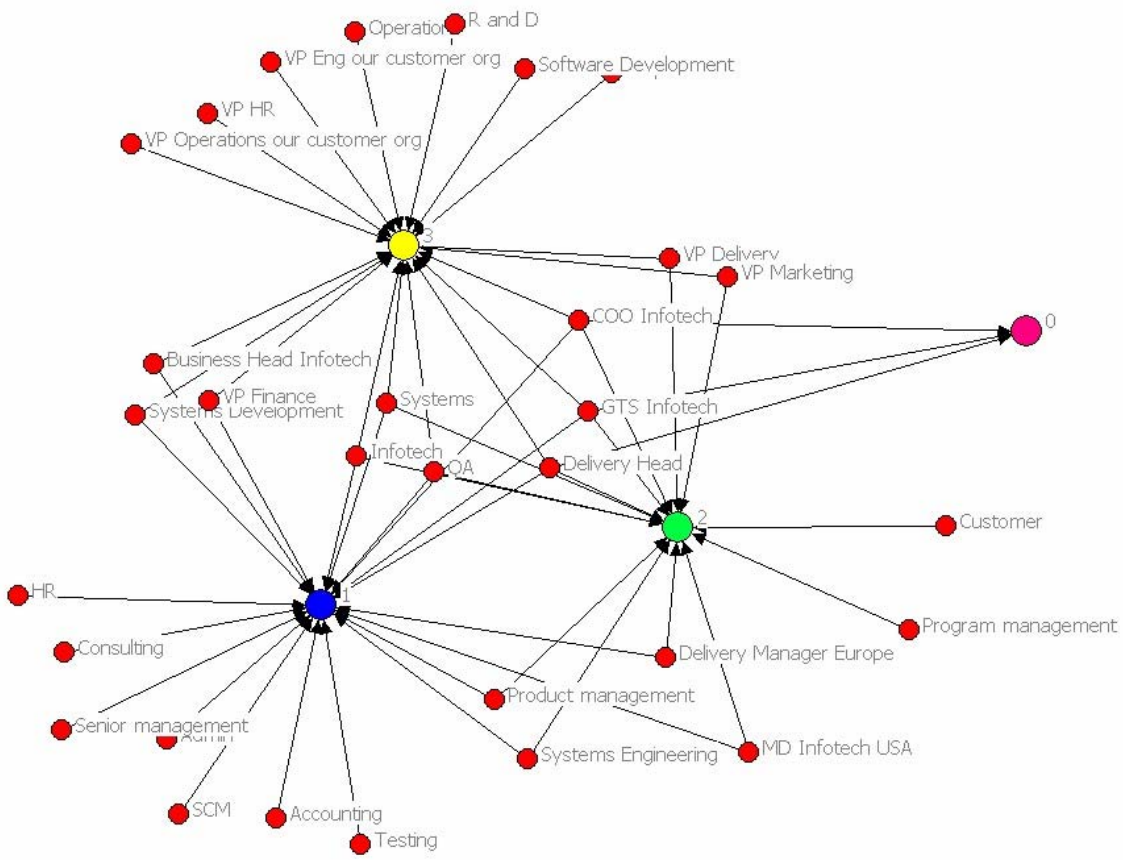


Figure 13: Telv Team Organizational Dept versus Infotype



Returning to our original research questions, what can we learn from these case studies. Does generation, tenure in the organization, and/or years of professional experience have an impact on the types of knowledge that are exchanged via cross-generational knowledge flows in edge organizations, in order for the organizations to meet their strategic objectives? From our exploratory case studies using the Net and Telv teams, we found that information flow networks are formed by knowledge sharing within the teams, especially the geographically distributed team like the Net Team. Organizational adaptability is a function of the ability to learn and to act upon due to shifting events (Leinonen and Bluemink, 2008; Anantatmula, 2007; Tseng, 2008; Courtney et al., 2007). On other hand, agility is the speed of response to potential changes. The Baby Boomers in both studied groups act as power networks, as they are directly linked to the leadership. They are the actors who invigorate others. Betweenness, as to the extent to which a particular actor is measured against (position) various other actors in the network, are again the Baby Boomers. Cross and Parker (2004) state that actors with high betweenness and those who are closely connected to them become high performers as well. For this reason, high energy tends to gather in discernible pockets within an organization and, in our case studies, is more visible in the Net Team.

Edge organizations highlight a degree of independence of the units. They are flexible, allowing teams to be set up in response to new tasks. The results of the surveys and our social network analysis suggest that resourcefulness can enhance the performance of people for a variety of tasks, including decision-making. Another characteristic of the edge organization is Situational Awareness (SA) which is about being aware of what is going on. Both teams indicated that Internal and External Effectiveness and Institutional Memory are among the categories for sharing and transferring knowledge. These categories are tightly linked to SA as well. The years of professional experience in Baby Boomers are strongly related with SA. From a recent experimental study [Marks et al., 2008], knowledge sharing was found to be facilitated by management's reminders of the importance of the goal and reminders about rivals. In the same study, knowledge sharing was more likely to occur with individuals with prosocial traits--that is, people concerned more about the group collective goals versus individual agendas. In our case studies, we would need to further study the prosocial nature of the individuals among the teams.

In addressing the other two research questions and based on the exploratory case studies, the following were important as critical success factors for cross-generational knowledge flows: Shared understanding; reciprocity; intrinsic worth of the knowledge; subset of overlapping values to reduce generational gaps; convenient knowledge transfer mechanisms; and established trust/rapport. Shared understanding refers to having a mutual conveyance and agreement of ideas that are shared between two parties. Reciprocity refers to being willing to share one's knowledge because given a similar situation, the knowledge recipient would share his/her knowledge back with the individual. Intrinsic worth of knowledge refers to the value and merit of the knowledge being conveyed. A subset of overlapping values to reduce generational gaps is also important to lead to a common, shared understanding. Convenient knowledge transfer mechanisms need to exist for cross-generational knowledge flows so that "user adoption" will be enhanced. These knowledge transfer mechanisms could be either codified or personalized approaches to sharing knowledge. Last, having interpersonal trust and respect for each other will enhance knowledge sharing as well.

Curiously enough, these critical success factors aren't unique to just cross-generational knowledge flows. Most of the literature on knowledge management performance or success (Guo and Sheffield, 2008) highlights many of these factors. Interestingly too, the critical success factors for cross-generational knowledge flows in edge organizations, as exemplified in our two case studies, also reflect the same set of success factors with two caveats. The first caveat deals with establishing trust and rapport among the team members. This is especially important in edge organizations due to situational leadership, whereby the leadership changes based on the task at hand and the team leader may rotate according to the necessary set of skills and competencies needed for a given mission. The second caveat deals with having convenient knowledge transfer mechanisms. In an edge organization, network-centricity is a common factor; therefore, this should help provide convenient knowledge transfer mechanisms among the team.

In looking ahead towards the future, research in cross-generational knowledge flows, particularly in the context of edge organizations, is fertile ground. This is especially true in today's environment where knowledge retention issues loom over many organizations. Our exploratory case study approach is limited and generalizability may be difficult to attain due to the inherit qualities of the case study method. However, we believe our research confirms many of the hypotheses from our earlier research (Liebowitz et al., 2007).

4.0 Summary

With human capital strategy issues looming on many organizations, it becomes increasingly important to best leverage knowledge internally and externally for organizations to succeed. Furthermore, for organizations to be more adaptive and agile, especially in the case of edge organizations, fluid knowledge flows become even more paramount. Cross-generational knowledge flows in edge organizations is an exciting area of research that has been partly overlooked. This paper sheds some additional light on this topic by extending our previous research through the use of ontologies and social/organizational network analysis applied to real cases in defense and industry.

References

Alberts, D.S. and R.E. Hayes (2007), Planning Complex Endeavors, DoD Command and Control Research Program, Washington, D.C., http://www.dodccrp.org.

Alberts, D.S. and R.E. Hayes (2003), Power to the Edge: Command and Control in the Information Age, DoD Command and Control Research Program, Washington, D.C., http://www.dodccrp.org.

Anantatmula, V. (2007), "Linking KM Effectiveness Attributes to Organizational Performance," VINE: The Journal of Information and Knowledge Management Systems, Vol. 37, No. 2, Emerald.

Beck. K. (2000), Extreme Programming Explained: Embrace Change. Addison-Wesley.

Bedell, K. (2007), "Succession Planning: Generational Diversity," Talent Management Magazine, December.

Clippinger, J. (in press), Chapter Five, Human Nature and Social Networks, http://www.socialphysics.org/images/Human_Nature.pdf.

Courtney, H., E. Navarro, and C. O'Hare (2007), "The Dynamic Organic Transformational Team Model for High-Performance Knowledge Worker Teams," Team Performance Management Journal, Vol. 13, Nos. 1 and 2, Emerald.

Cross, R. and A. Parker (2004), The Hidden Power of Social Networks, Harvard Business School Press, Cambridge, MA.

DiRomualdo, T. (2006), "Viewpoint: Geezers, Grungers, GenXers, and Geeks: A Look at Workplace Generational Conflict," Journal of Financial Planning, October.

Foos, T., G. Schum., and S. Rothenberg (2006), "Tacit Knowledge Transfer and the Knowledge Disconnect", Journal of Knowledge Management, Vo. 10, No. 1, 6-18, Emerald Group Publishing.

Gomez-Perez A., M. Fernandez-Lopez, and O. Corcho (2004), "Ontological Engineering with Examples from the Areas of Knowledge Management, e-Commerce and the Semantic Web." Advanced Information and Knowledge Processing. Springer.

Guo, Z. and J. Sheffield (2008), "A Paradigmatic and Methodological Examination of Knowledge Management Research: 2000 to 2004", Decision Support Systems Journal, Vol. 44, February, Elsevier.

Hunt. J. (2003), "Guide to the Unified Process featuring UML, Java and Design Patterns."Springer Professional Computing. Springer Verlag, September.

Katzenbach Partners (2007), "The Informal Organization," New York, New York.

Leinonen, P. and J. Bluemink (2008), "The Distributed Team Members' Explanations of Knowledge They Assume to be Shared," Journal of Workplace Learning, Vol. 20, No. 1, Emerald.

Liebowitz, J. (2007c), Social Networking: The Essence of Innovation, Scarecrow Press/Rowman & Littlefield, Lanham, Md.

Liebowitz, J. (2006a), What They Didn't Tell You About Knowledge Management, Scarecrow Press/Rowman & Littlefield, Lanham, Md.

Liebowitz, J. (2006b), Strategic Intelligence: Business Intelligence, Competitive Intelligence, and Knowledge Management, Auerbach Publishing/Taylor & Francis, New York.

Liebowitz, J. (ed)(2008), Making Cents Out of Knowledge Management, Scarecrow Press/Rowman & Littlefield.

Liebowitz, J. (in press), Knowledge Retention: Strategies and Solutions, Auerbach Publishing/Taylor & Francis.

Liebowitz, J., N. Ayyavoo, H. Nguyen, D. Carran, and J. Simien (2007a), "Cross-Generational Knowledge Flows in Edge Organizations," Industrial Management & Data Systems Journal, Vol. 107, No. 2, Emerald Publishers.

Liebowitz, J., R. Bali, and N. Wickramasinghe (eds.)(2007b), "Special issue on Social Networking and Knowledge Flows in Organizations," International Journal of Networking and Virtual Organizations, Vol. 4, No. 4, Inderscience.

Marks, P., P. Polak, S. McCoy, and D. Galletta (2008), "Sharing Knowledge", Communications of the ACM, Vol 51, No. 2, February.

Nissen, M.E. (2007), "Enhancing Organizational Metacognition: Flow Visualization to Make the Knowledge Network Explicit", International Journal on Networking and Virtual Organizations, Vol. 4, No. 4, Inderscience .

Nissen, M.E. (2006), Harnessing Knowledge Dynamics, IRM Press, Hershey, PA.

Noy, N. F. and D. McGuinness (2001), "Ontology Development 101: A Guide to Creating Your First Ontology." Technical Report KSL-01-05 and SMI-2001-0880, Stanford Knowledge Systems Laboratory and Stanford Medical Informatics, Palo Alto, CA.

Perrolle, P. and F. Moris (2007), "Advancing Measures of Innovation: Knowledge Flows, Business Metrics, and Measurement Strategies," National Science Foundation, Workshop Repoprt NSF 07-306, Washington, D.C., January.

Polites, G. and R. Watson (2008), "The Centrality and Prestige of CACM", Communications of the ACM, Vol. 51, No. 1, January.

Protégé editor 3.3.1 available at http://protege.stanford.edu/.Last accessed on 11/05/07.

Sure Y. and R. Studer (2002)," On-to-knowledge methodology." On-To-Knowledge Deliverable 18, AIFB, University of Karlsruhe, 2002. Available at http://www.aifb.unikarlsruhe.de/WBS/ysu/publications/OTK-D18 v1-0.pdf.

Swartout, W. and A. Tate (1999), "Ontologies: Guest Editors' Introduction," IEEE Intelligent Systems 14, 1, Special Issue on Ontologies (Jan./Feb.), 18–19.

Tseng, S.M. (2008), "Knowledge Management System Performance Measure Index," Expert Systems With Applications: An International Journal, Vol. 34, Elsevier.

Wei, K. (2006), "Understanding the Impact of National Cultural Difference on Knowledge Sharing Process in Global Virtual Teams", The 5th Annual Knowledge Management Doctoral Consortium, presented at Queen's University, Kingston, Canada.
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Yoo, Y., K. Lyytinen, and D. Heo (2007), "Closing the Gap: Towards a Process Model of Post-Merger Knowledge Sharing," Information Systems Journal, Vol. 17, Blackwell Publishing.

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